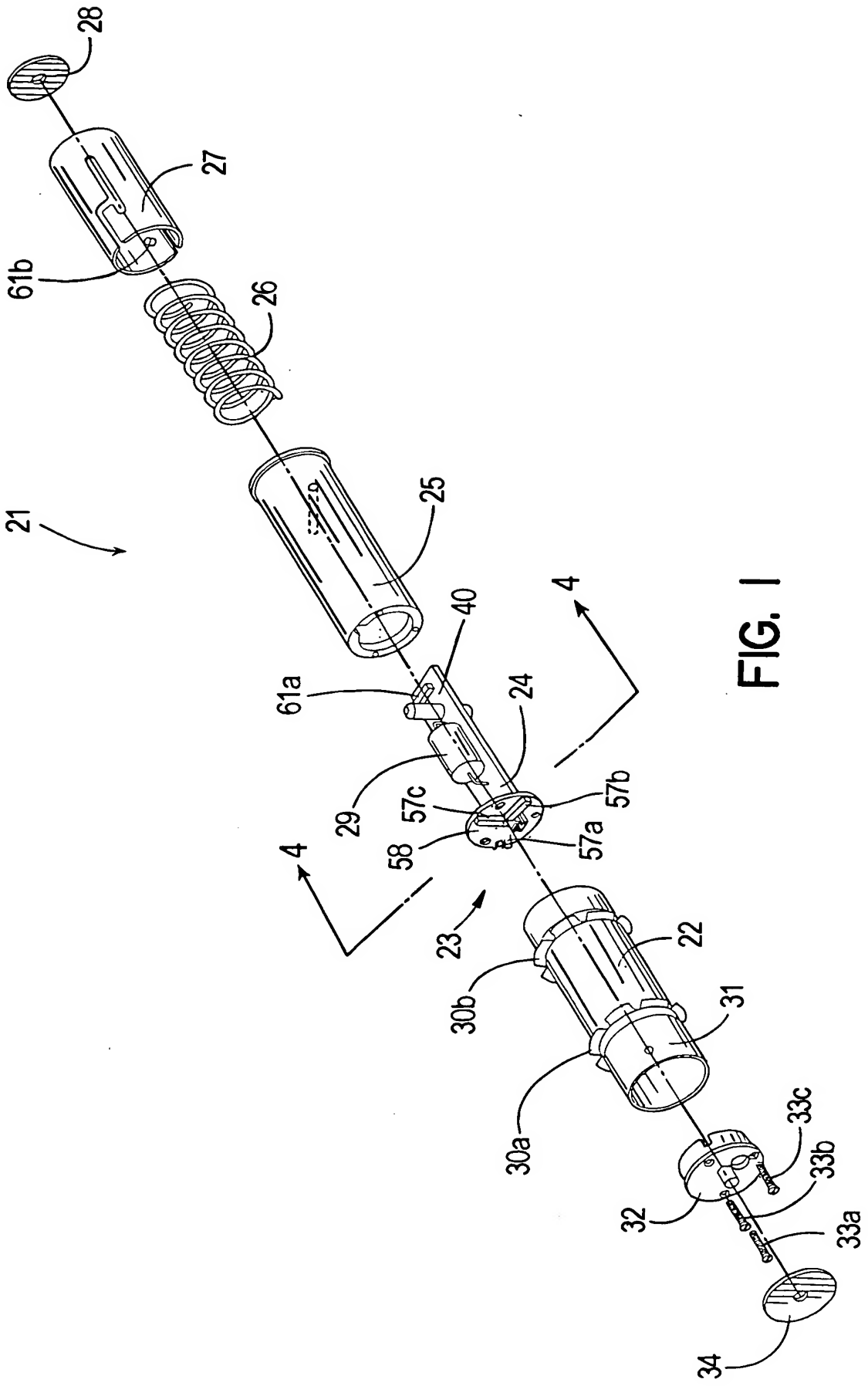

28
27
61b
26
21
25
40
61a
24
4
29
57c
57b
58
57a
4
23
22
30b
31
30a
33c
33b
32
33a
34

FIG. 1

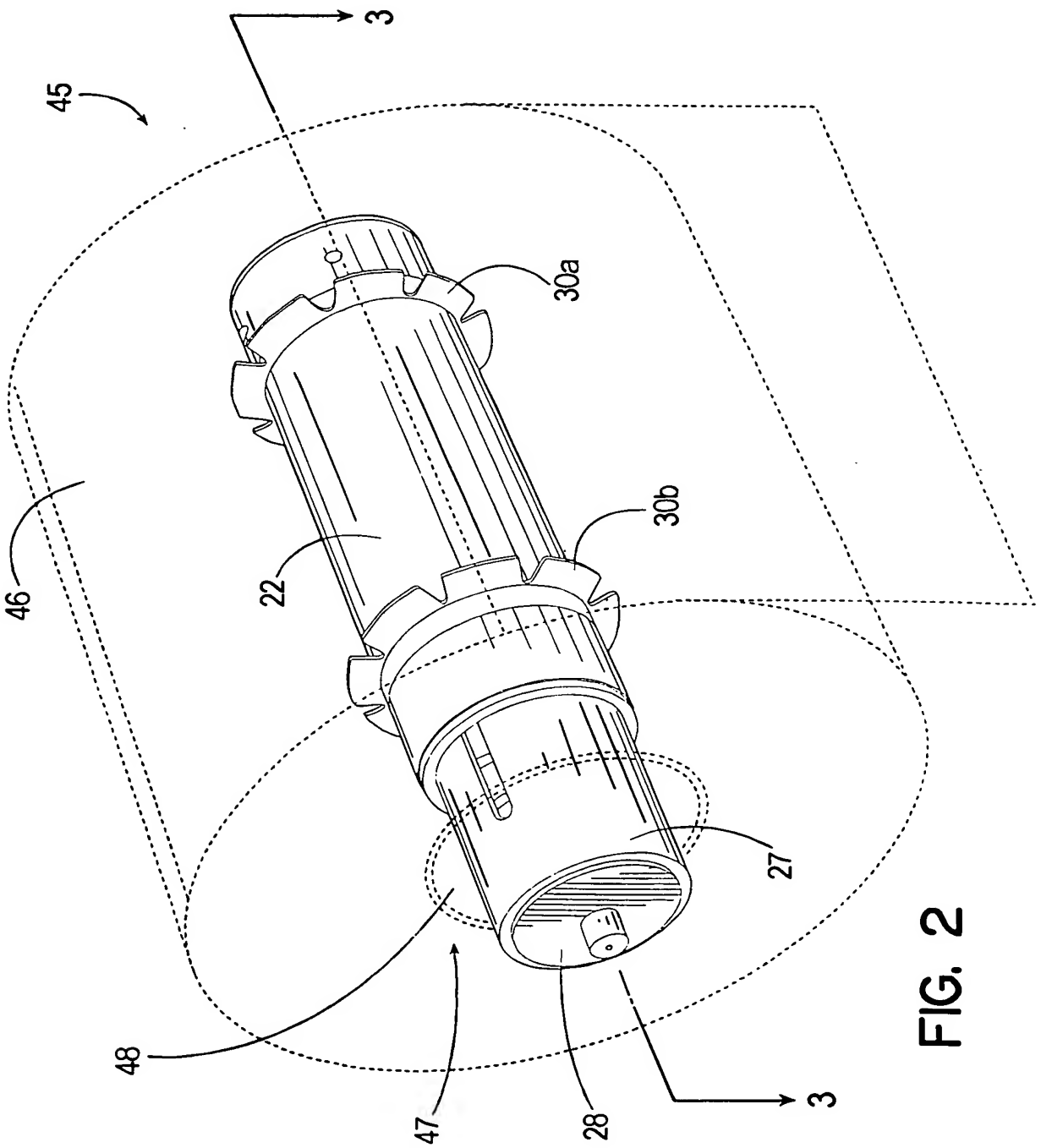


FIG. 2

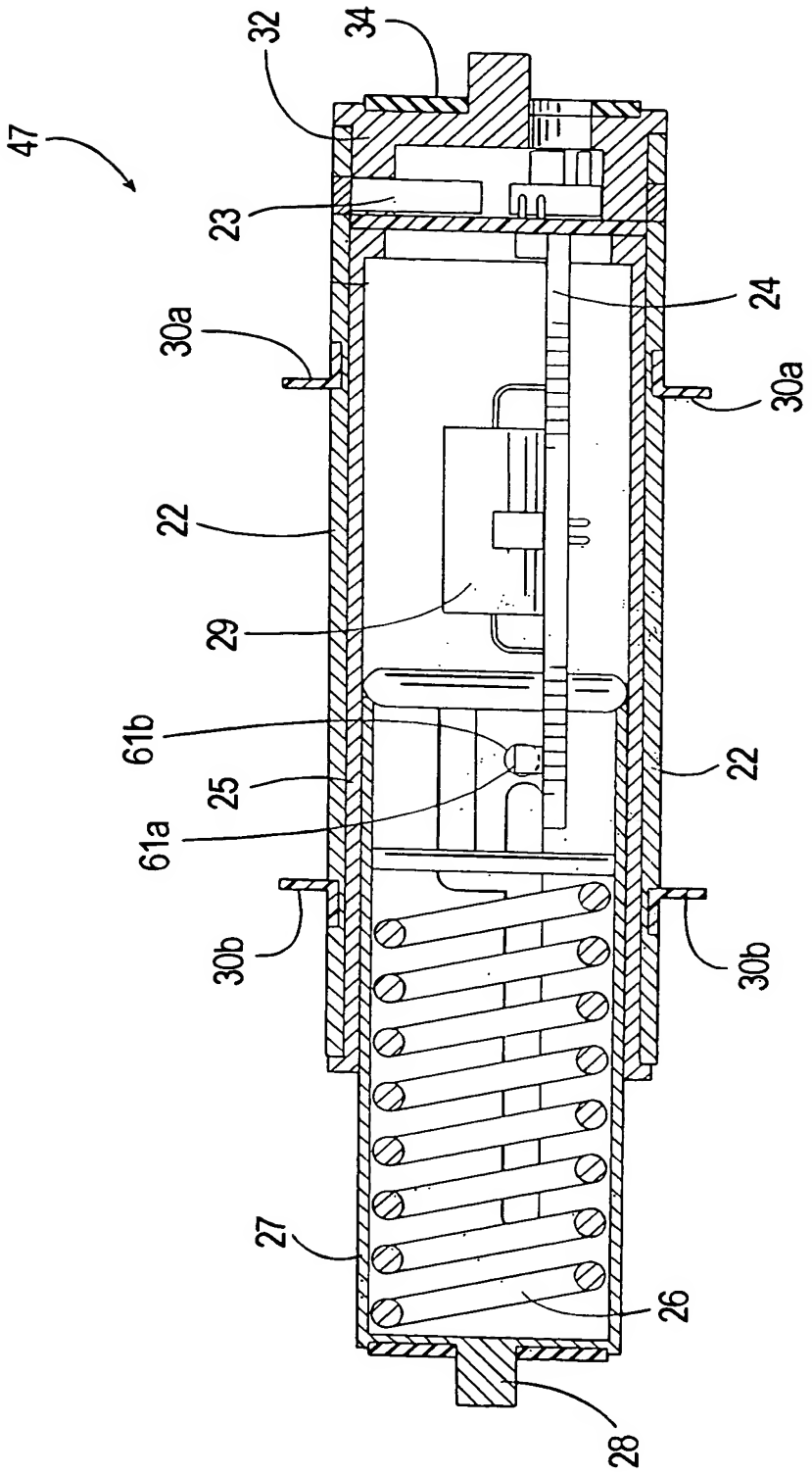


FIG. 3

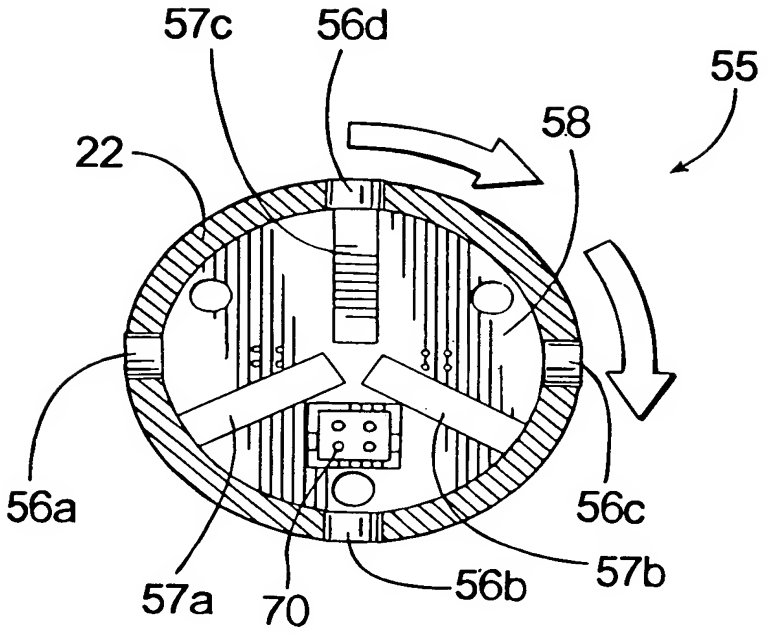


FIG. 4

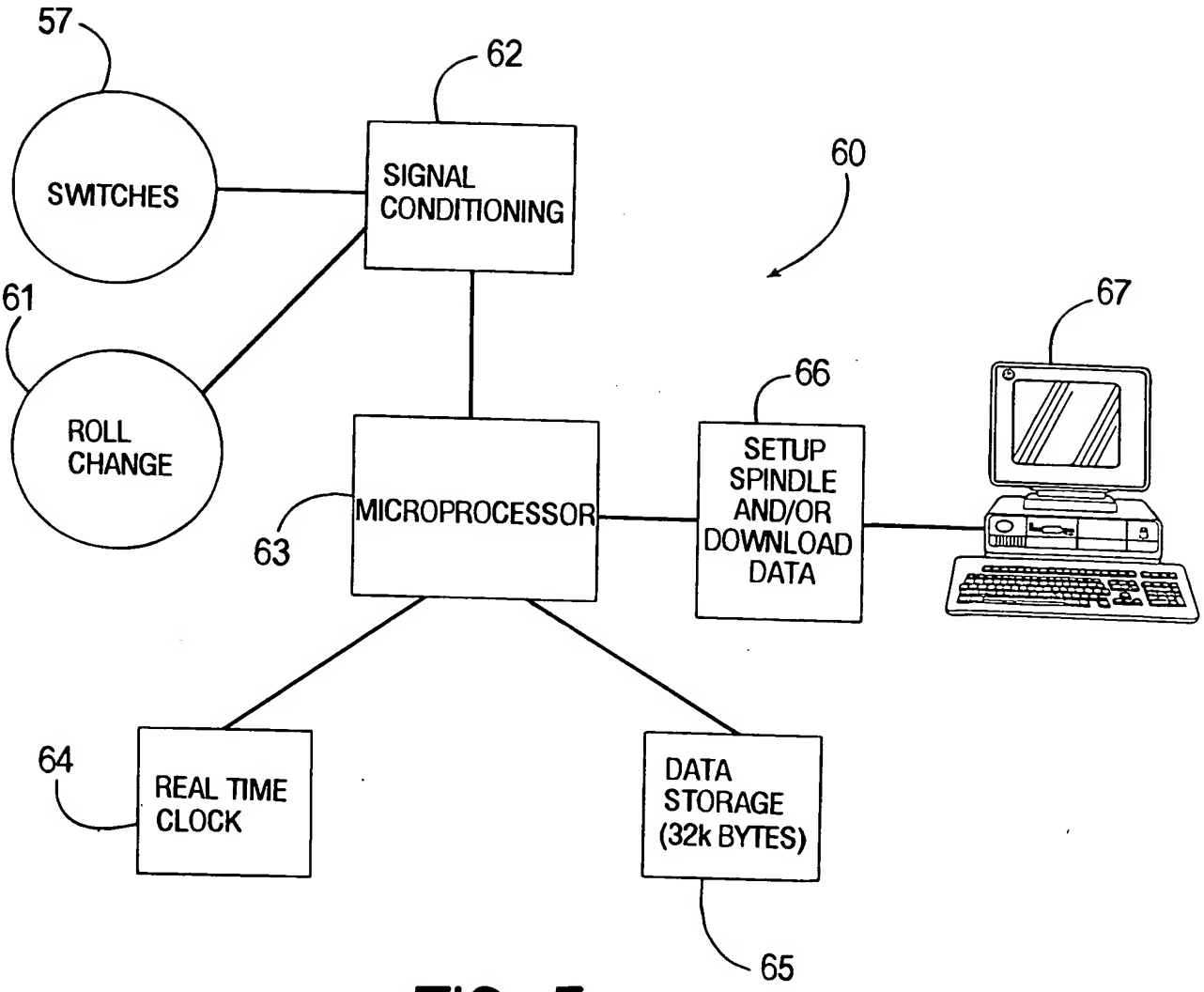

57
62
SWITCHES
SIGNAL CONDITIONING
60
61
67
66
ROLL CHANGE
MICROPROCESSOR
SETUP SPINDLE AND/OR DOWNLOAD DATA
63
64
REAL TIME CLOCK
DATA STORAGE (32k BYTES)
65

FIG. 5

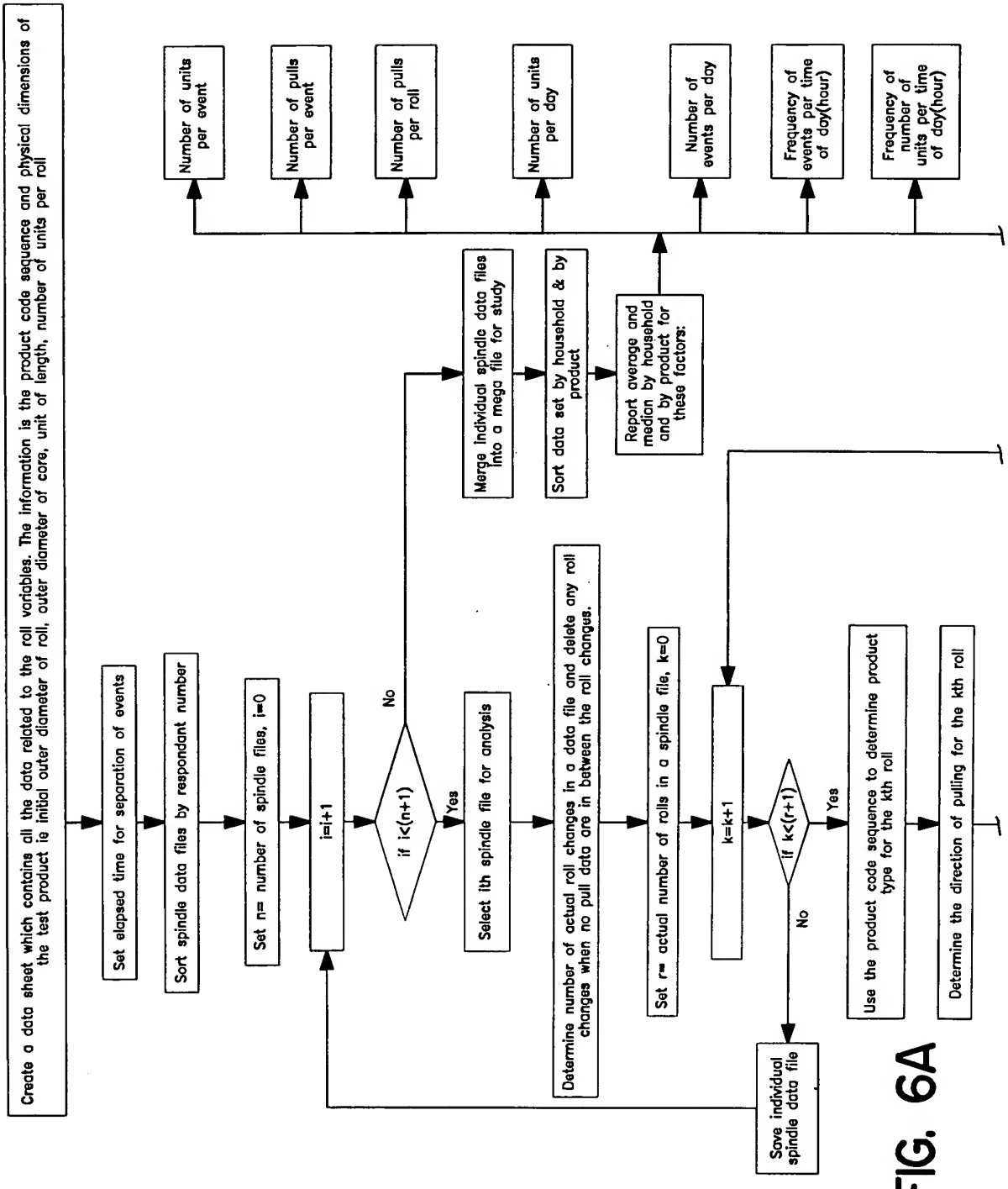
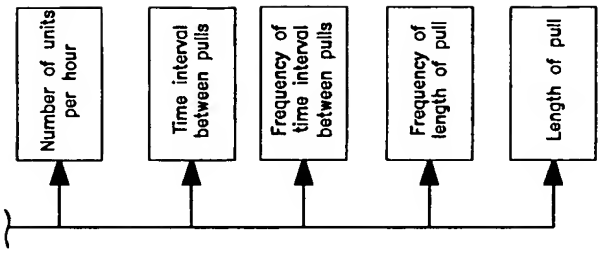

Create a data sheet which contains all the data related to the roll variables. The information is the product code sequence and physical dimensions of the test product ie initial outer diameter of roll, outer diameter of core, unit of length, number of units per roll
Set elapsed time for separation of events
Sort spindle data files by respondant number
Set n= number of spindle files, i=0
i=i+1
if i<(n+1)
No
Yes
Select ith spindle file for analysis
Determine number of actual roll changes in a data file and delete any roll changes when no pull data are in between the roll changes.
Set r= actual number of rolls in a spindle file, k=0
k=k+1
if k<(r+1)
No
Yes
Save individual spindle data file
Use the product code sequence to determine product type for the kth roll
Determine the direction of pulling for the kth roll
Merge individual spindle data files into a mega file for study
Sort data set by household & by product
Report average and median by household and by product for these factors:
Number of units per event
Number of pulls per event
Number of pulls per roll
Number of units per day
Number of events per day
Frequency of events per time of day(hour)
Frequency of number of units per time of day(hour)

FIG. 6A


Number of units per hour
Time interval between pulls
Frequency of time interval between pulls
Frequency of length of pull
Length of pull

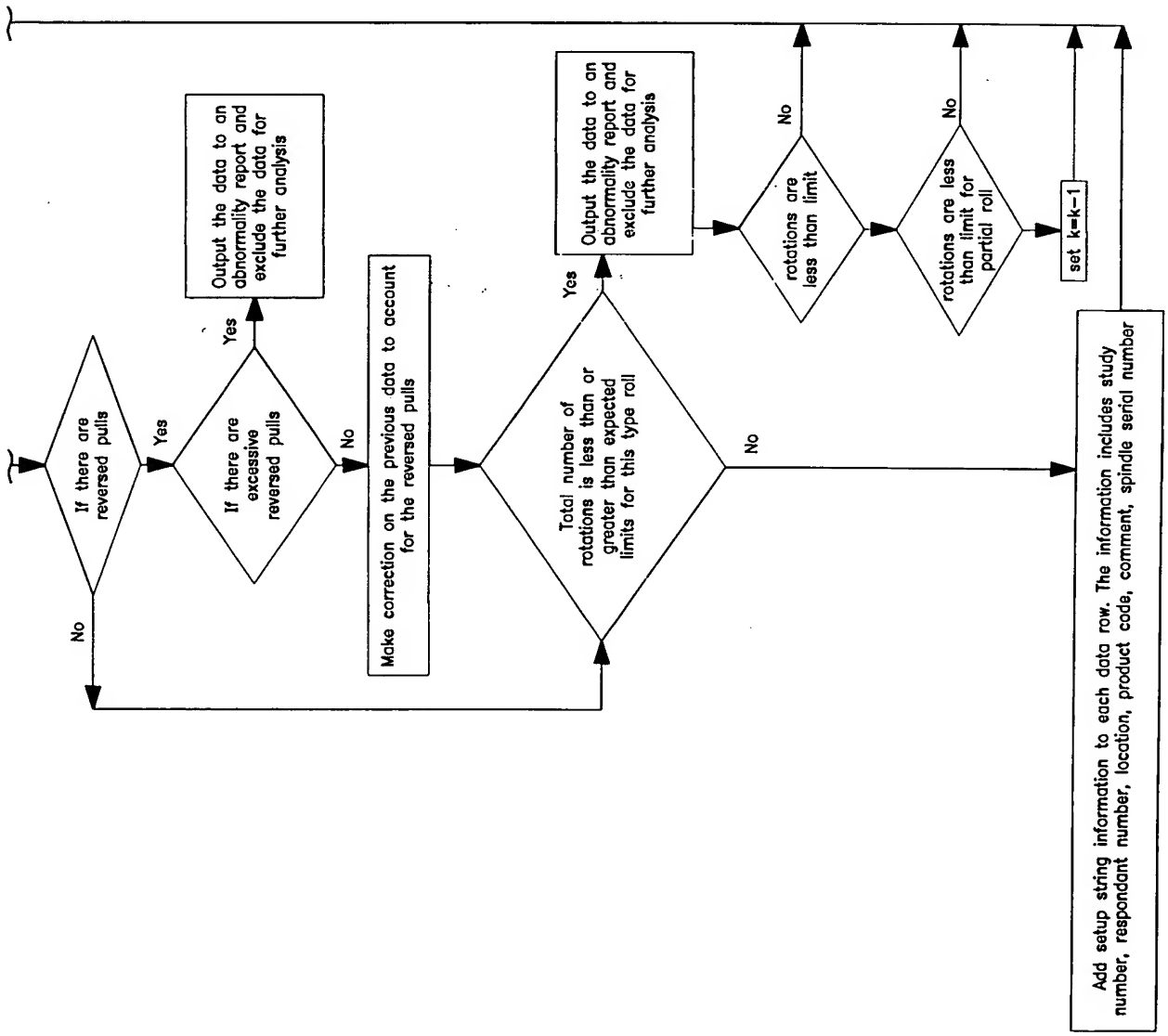

If there are reversed pulls
Yes
No
If there are excessive reversed pulls
Yes
No
Output the data to an abnormality report and exclude the data for further analysis
Make correction on the previous data to account for the reversed pulls
Total number of rotations is less than or greater than expected limits for this type roll
Yes
No
Output the data to an abnormality report and exclude the data for further analysis
rotations are less than limit
No
rotations are less than limit for partial roll
No
set k=k-1
Add setup string information to each data row. The information includes study number, respondant number, location, product code, comment, spindle serial number

FIG. 6B

Use of Smart Spindl for toil t paper utility in Consumer Home

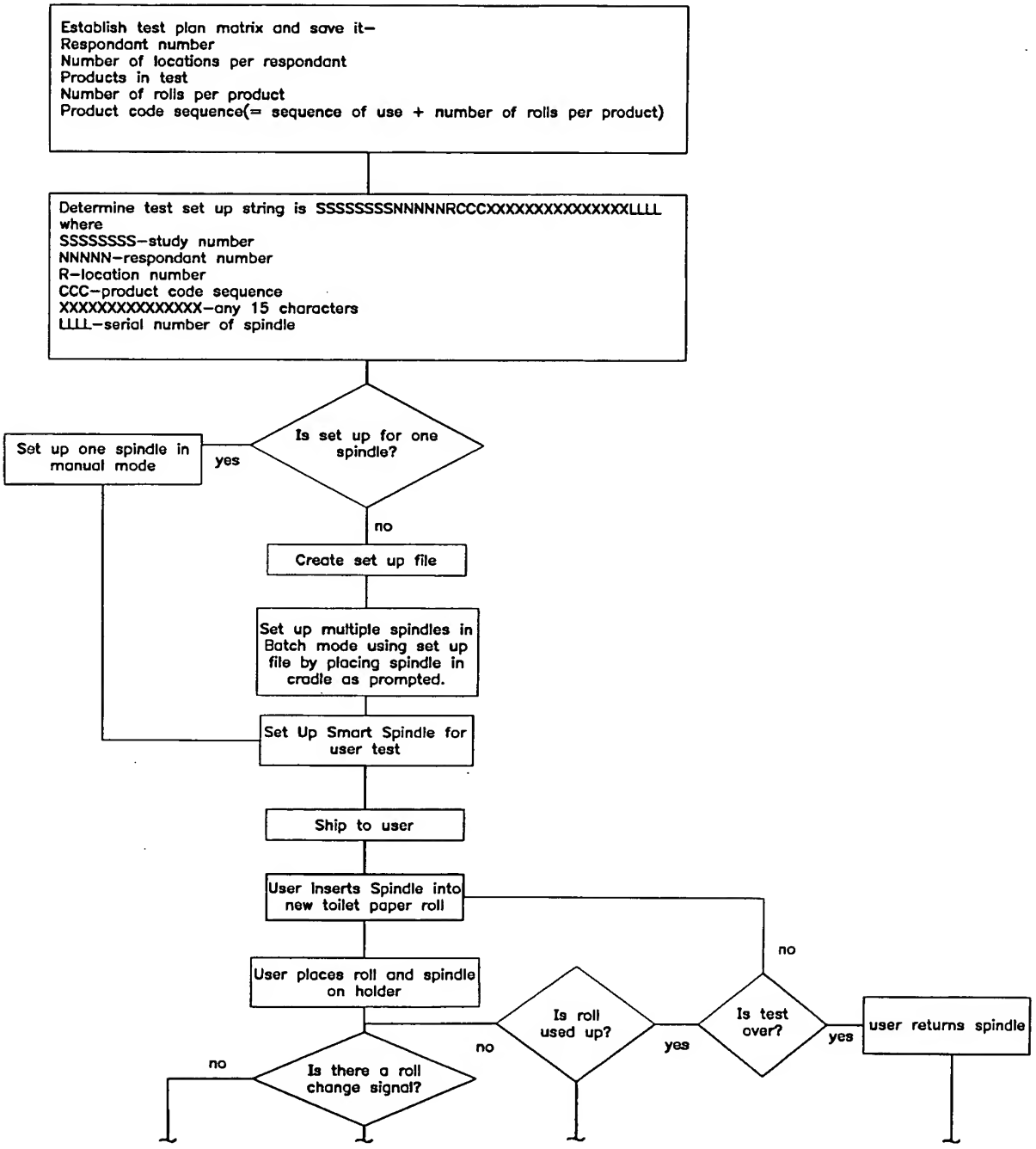


FIG. 7A

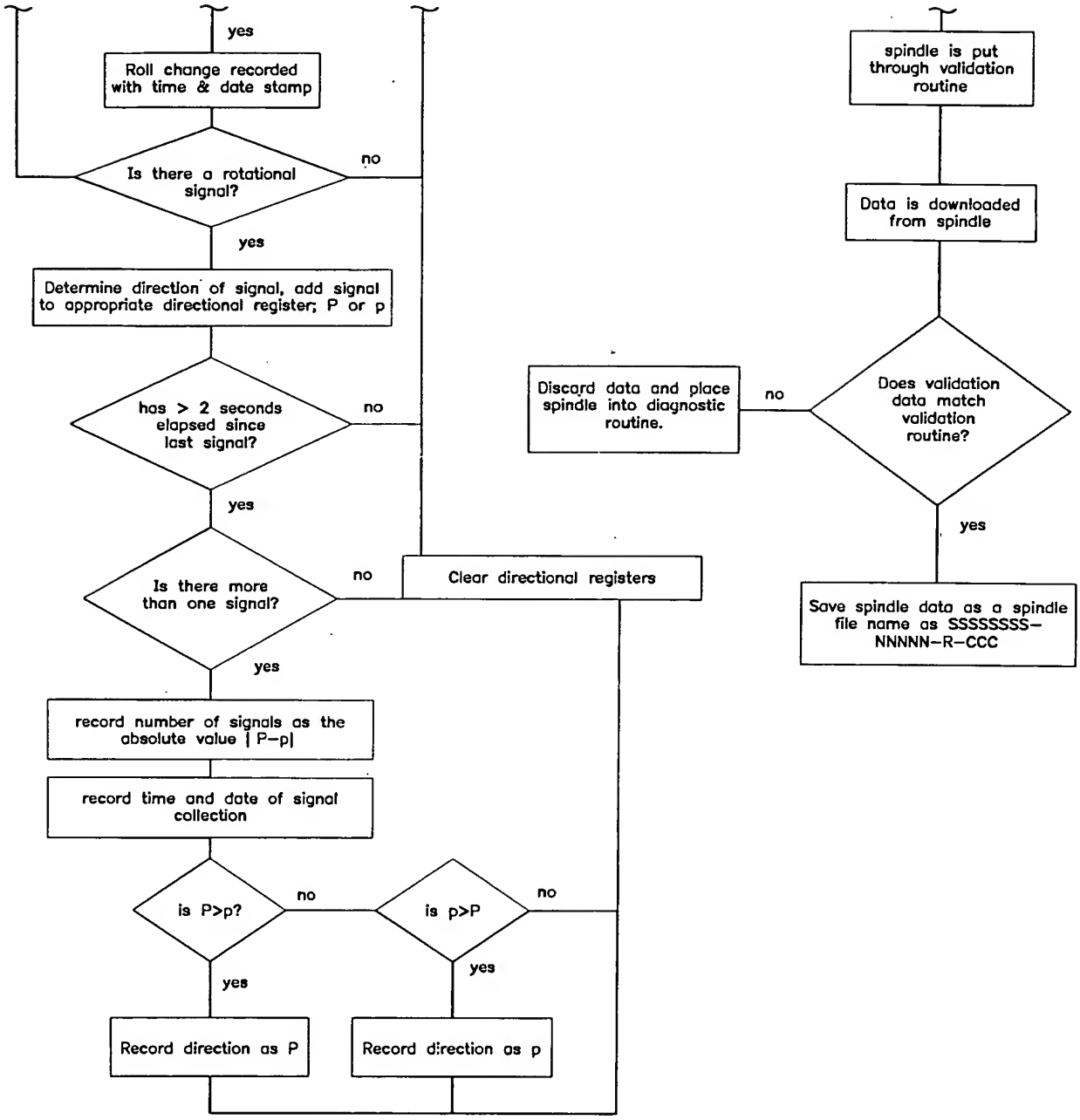

yes
Roll change recorded with time & date stamp
Is there a rotational signal?
no
yes
Determine direction of signal, add signal to appropriate directional register; P or p
has > 2 seconds elapsed since last signal?
no
yes
Is there more than one signal?
no
Clear directional registers
yes
record number of signals as the absolute value | P−p|
record time and date of signal collection
is P>p?
no
is p>P
no
yes
yes
Record direction as P
Record direction as p
spindle is put through validation routine
Data is downloaded from spindle
Does validation data match validation routine?
no
Discard data and place spindle into diagnostic routine.
yes
Save spindle data as a spindle file name as SSSSSSSS−NNNNN−R−CCC

FIG. 7B

Use of Smart Spindle to control an inventory in Consumer Home, retailstore

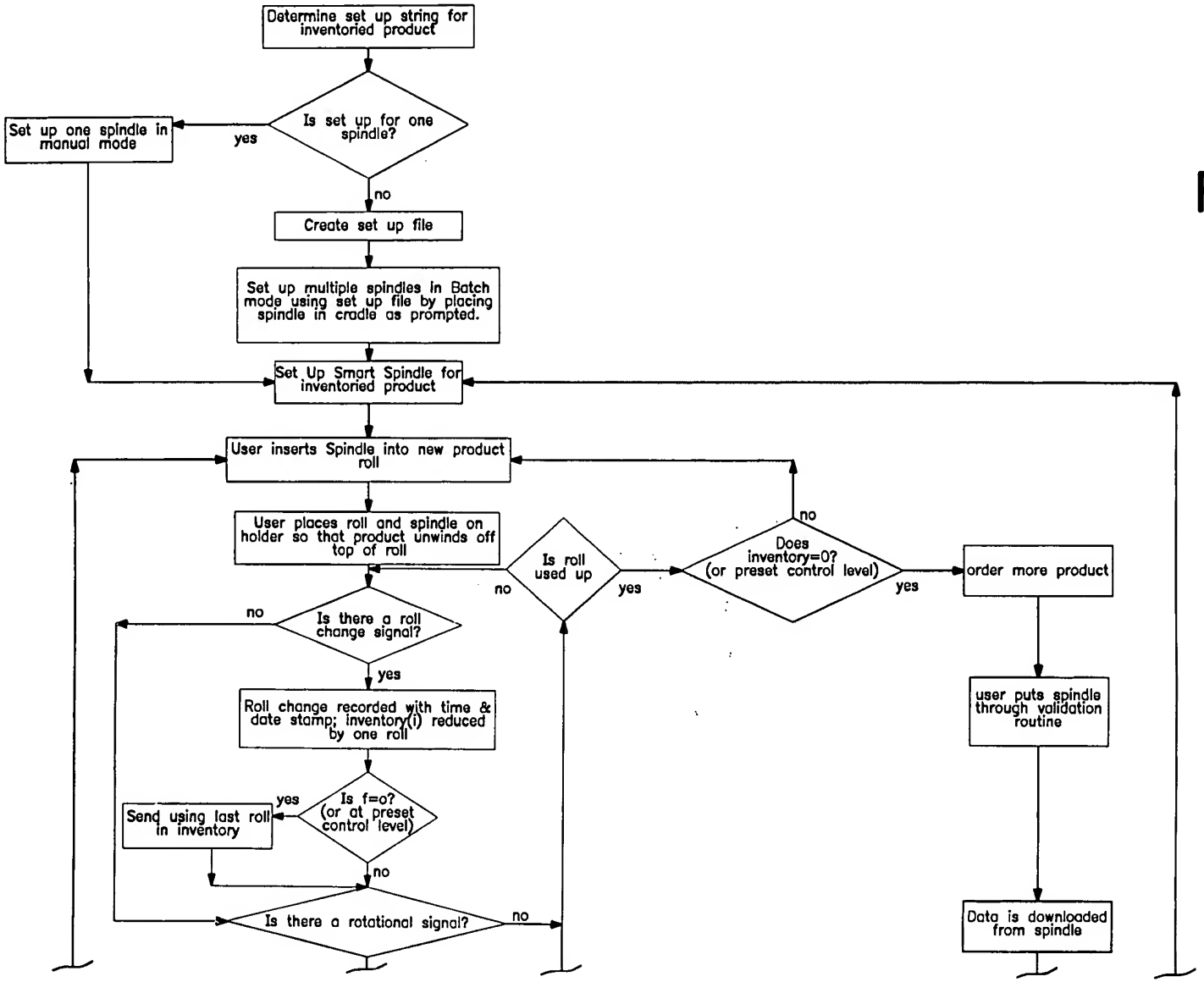


FIG. 8A

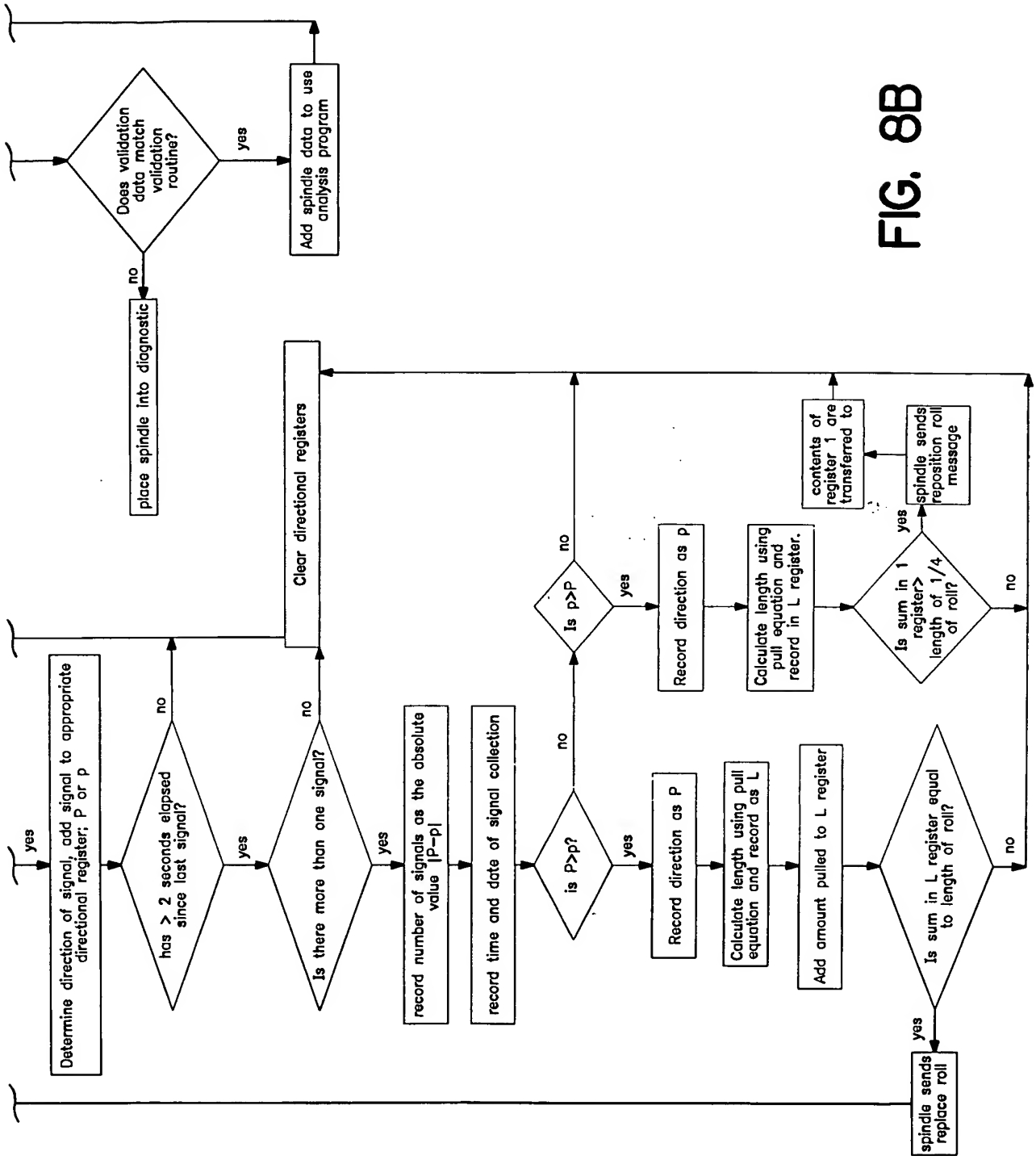

Determine direction of signal; add signal to appropriate directional register; P or p
yes
has > 2 seconds elapsed since last signal?
no
yes
Is there more than one signal?
no
yes
record number of signals as the absolute value |P-p|
record time and date of signal collection
is P>p?
no
yes
Record direction as P
Calculate length using pull equation and record as L
Add amount pulled to L register
Is sum in L register equal to length of roll?
no
yes
spindle sends replace roll
Is p>P
no
yes
Record direction as p
Calculate length using pull equation and record in L register.
Is sum in 1 register> length of 1/4 of roll?
no
yes
spindle sends reposition roll message
contents of register 1 are transferred to
Clear directional registers
Does validation data match validation routine?
no
yes
place spindle into diagnostic
Add spindle data to use analysis program

FIG. 8B

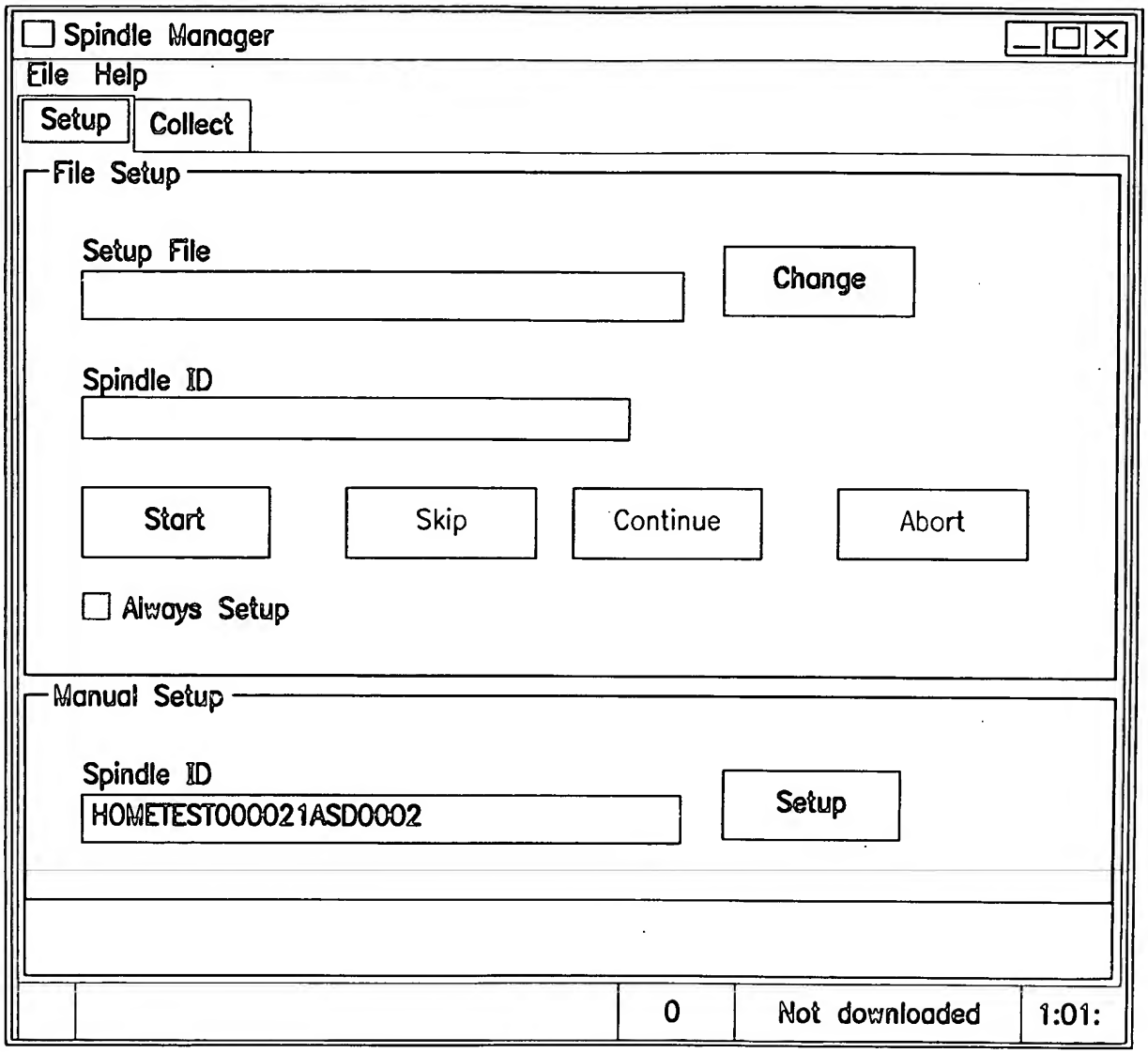

Spindle Manager
File Help
Setup
Collect
File Setup
Setup File
Change
Spindle ID
Start
Skip
Continue
Abort
Always Setup
Manual Setup
Spindle ID
HOMETEST000021ASD0002
Setup
0
Not downloaded
1:01:

FIG. 9

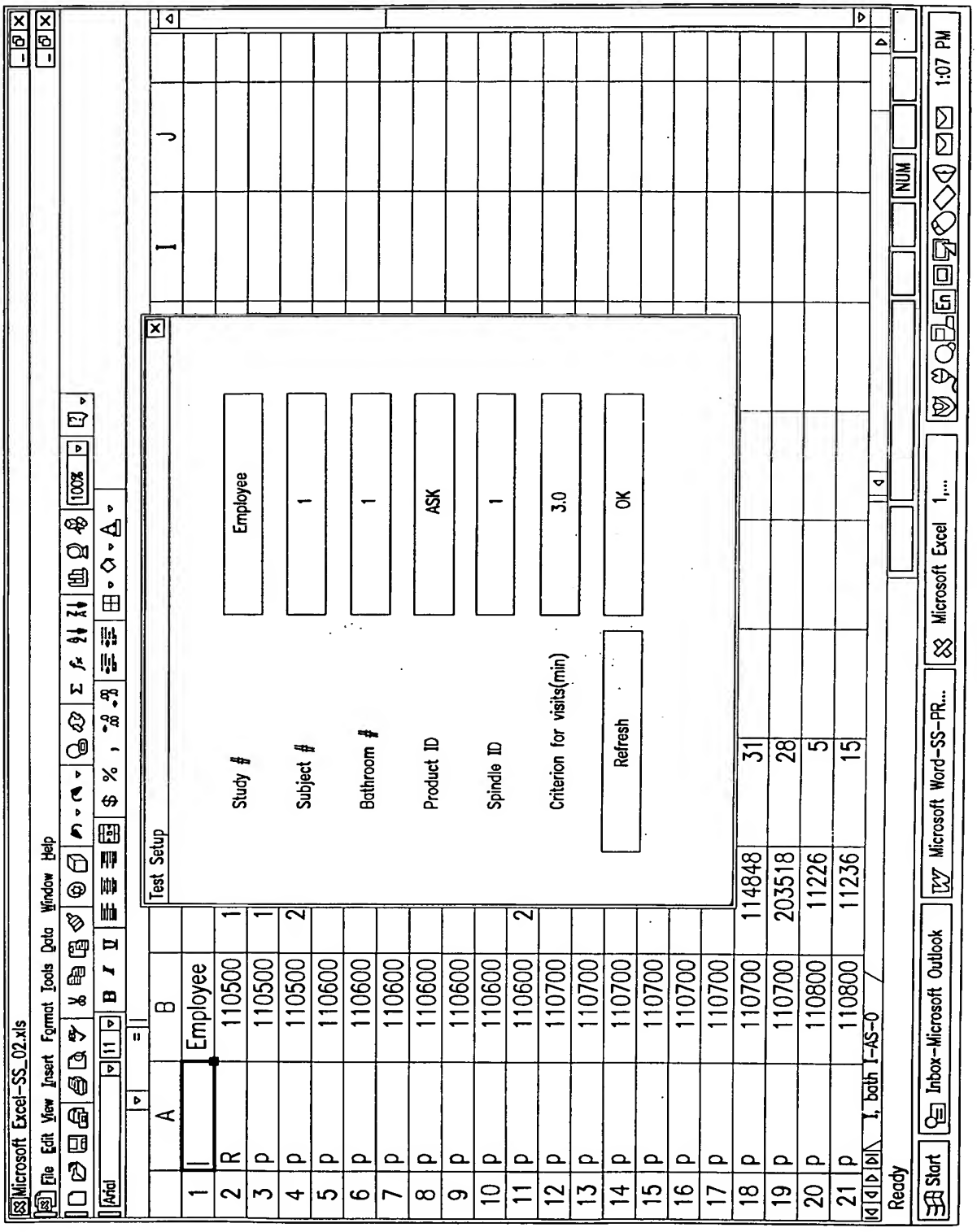

Microsoft Excel-SS_02.xls
File Edit View Insert Format Tools Data Window Help
Test Setup
Study #
Employee
Subject #
1
Bathroom #
1
Product ID
ASK
Spindle ID
1
Criterion for visits(min)
3.0
Refresh
OK
Employee
110500 1
110500 1
110500 2
110600
110600
110600
110600
110600
110600 2
110700
110700
110700
110700
110700
110700
114848 31
110700 203518 28
110800 11226 5
110800 11236 15
Ready
Start
Inbox-Microsoft Outlook
Microsoft Word-SS-PR...
Microsoft Excel 1,...
1:07 PM

FIG. 10

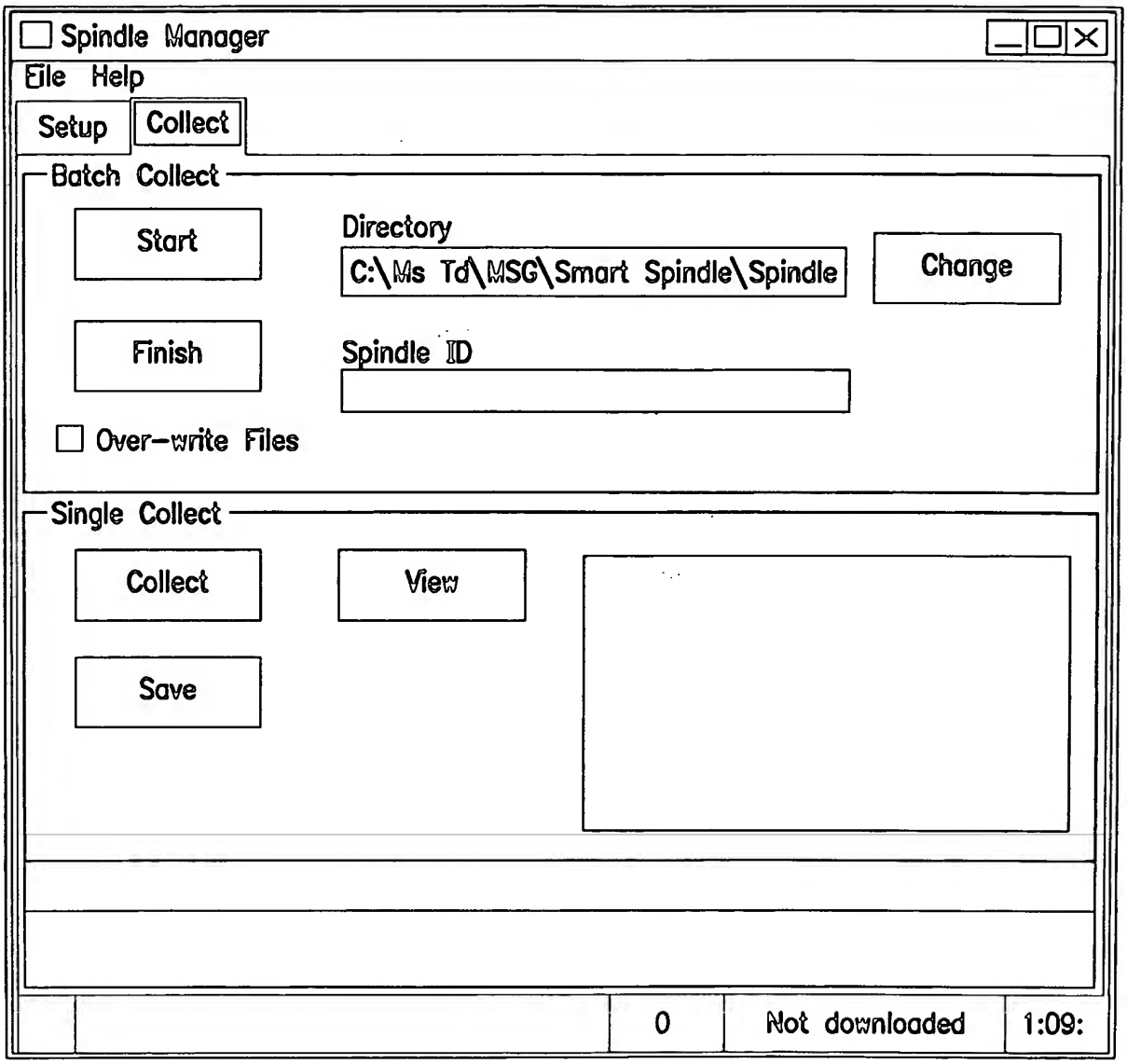

Spindle Manager
File Help
Setup
Collect
Batch Collect
Start
Directory
C:\Ms Td\MSG\Smart Spindle\Spindle
Change
Finish
Spindle ID
Over-write Files
Single Collect
Collect
View
Save
0
Not downloaded
1:09:

FIG. 11

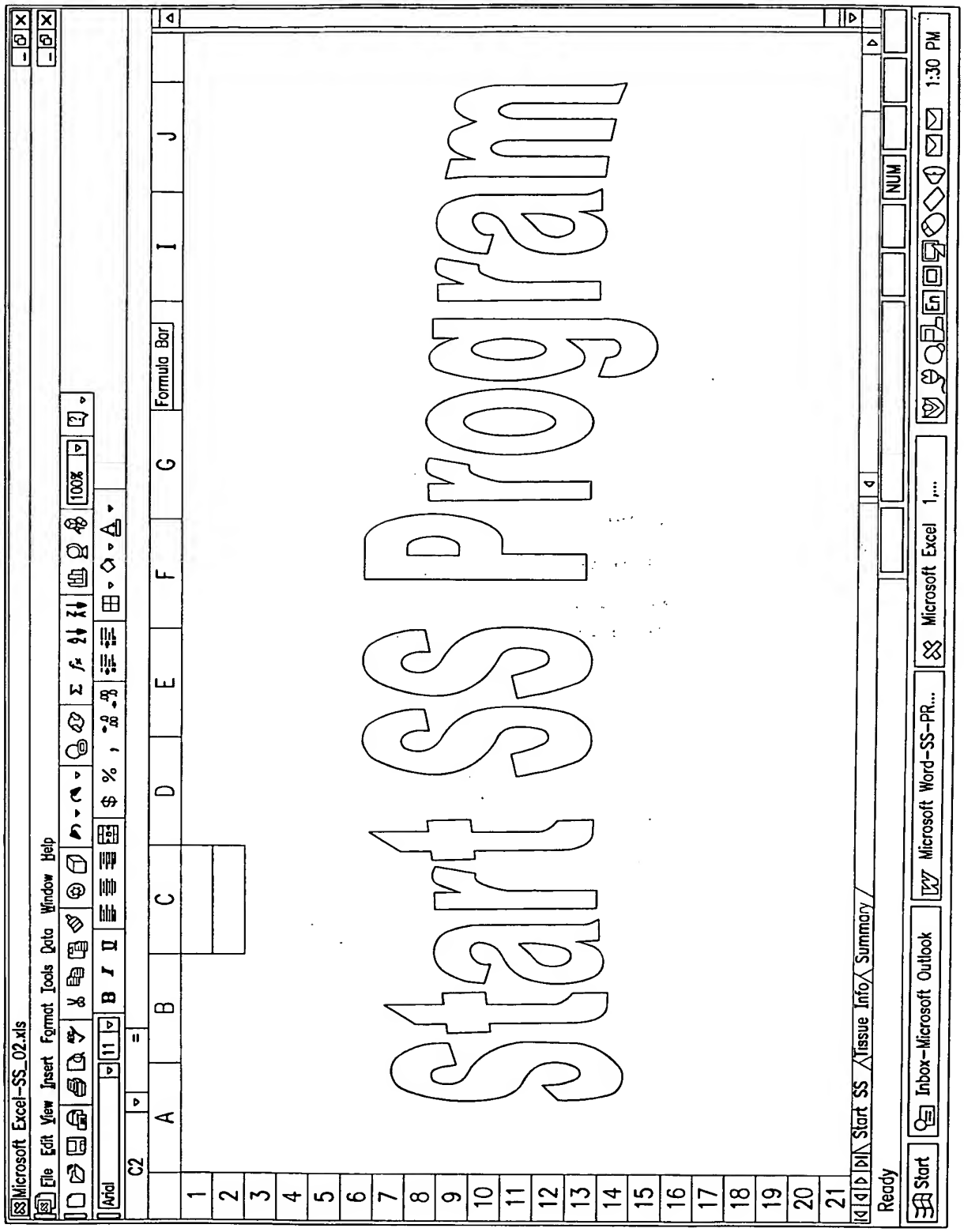

Microsoft Excel-SS_02.xls
File Edit View Insert Format Tools Data Window Help
Arial
11
C2
Formula Bar
Start SS Program
Start SS
Tissue Info
Summary
Ready
Start
Inbox-Microsoft Outlook
Microsoft Word-SS-PR...
Microsoft Excel 1,...
NUM
1:30 PM

FIG. 12

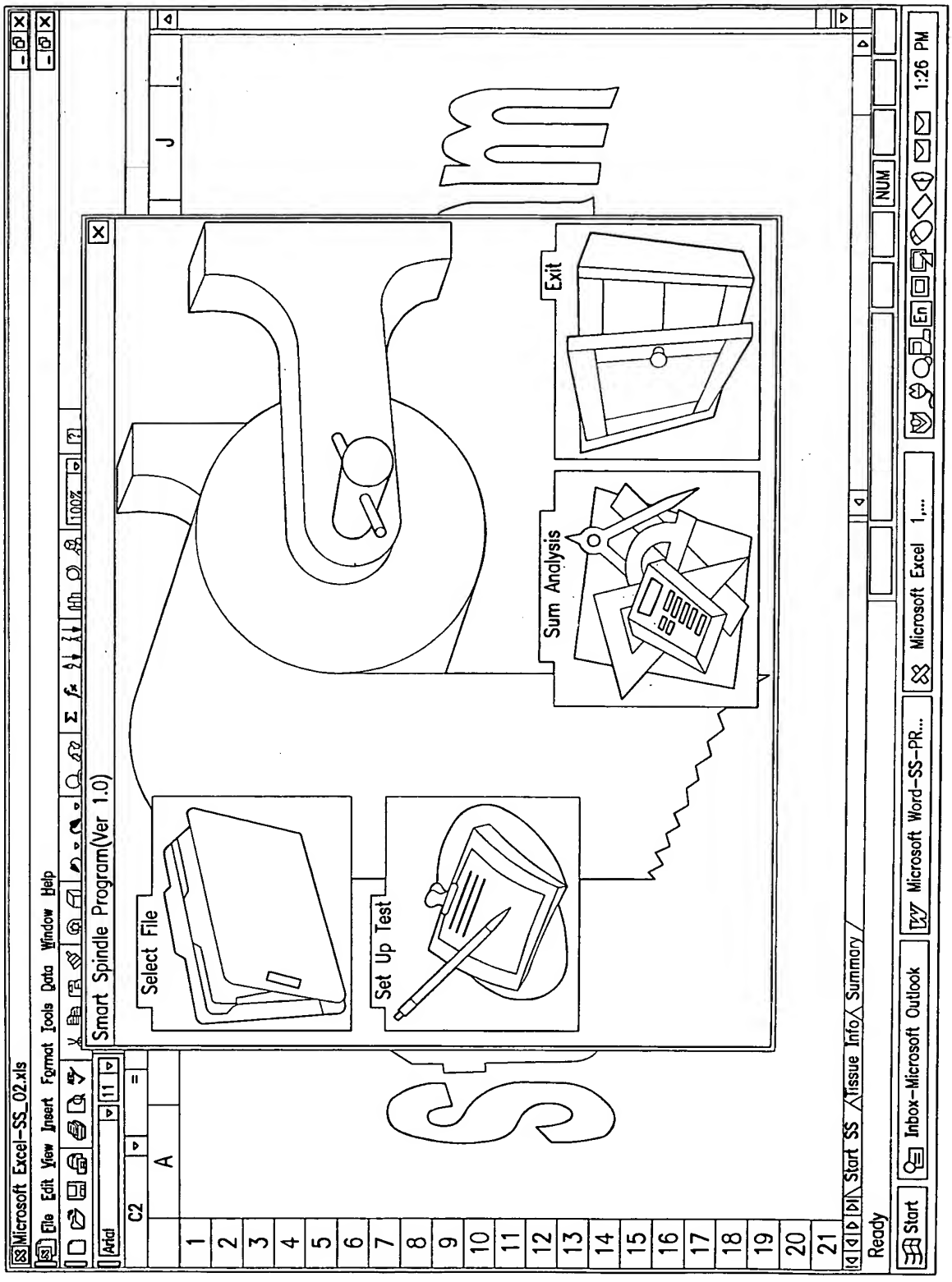

Microsoft Excel-SS_02.xls
File Edit View Insert Format Tools Data Window Help
Arial
C2
A
Smart Spindle Program(Ver 1.0)
Select File
Set Up Test
Sum Analysis
Exit
SS
Ready
Start
Inbox-Microsoft Outlook
Microsoft Word-SS-PR...
Microsoft Excel 1,...
NUM
1:26 PM

FIG. 13